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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
LEUNG, QUYEN PHAN	
ART UNIT	PAPER NUMBER
2828	

DATE MAILED: 01/13/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 07-01)

Office Action Summary	Application N .	Applicant(s)
	09/867,865	VUSIRIKALA, VIJAYANAND
	Examin r	Art Unit
	Quyen P. Leung	2828

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on ______ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-20 is/are pending in the application.

4a) Of the above claim(s) ______ is/are withdrawn from consideration.

5)☐ Claim(s) ______ is/are allowed.

6)☒ Claim(s) 1-20 is/are rejected.

7)☐ Claim(s) ______ is/are objected to.

8)☐ Claim(s) ______ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on ______ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on ______ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. ______ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 3 .
4) ☐ Interview Summary (PTO-413) Paper No(s). ______ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 1-20 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. It is not clear what structural limitations are implied by each of the stabilizer module, the first module, the second module, the power module, a determination module, a current module. Further it is not clear what operating characteristics of the VCSEL would determine that the modes of the VCSEL are unstable.

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 1-20 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

5. Claims 1-20 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential structural cooperative relationships of elements, such omission amounting to a gap between the necessary structural connections. See

MPEP § 2172.01. The omitted structural cooperative relationships are: between the VCSEL and each of the stabilizer module, the first module, the second module, the power module, the determination module, and the current module.

6. Claims 1-6 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential elements, such omission amounting to a gap between the elements. See MPEP § 2172.01. The omitted elements are: the vertical cavity means (i.e. the upper and lower DBRs sandwiching the active region), the pumping means (i.e. electrodes) for causing the VCSEL to emit laser light.

7. Claims 7-10 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential steps, such omission amounting to a gap between the steps. See MPEP § 2172.01. The omitted steps are: steps for generating modes in the VCSEL, steps for biasing the VCSEL.

8. Claim 10 is unclear because it has a typographical error in that it should depend upon claim 7 and not 11.

9. Claim 13 recites a process step in a device claim. It is not clear what the applicant wishes to claim in claim 13, a device or a process.

10. Claims 14 and 19 are unclear because they lack an ending period.

Claim Rejections - 35 USC § 102

11. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

12. Claims 1-20 are rejected under 35 U.S.C. 102(b) as being anticipated by O'Brien et al (6,040,590). O'Brien et al discloses the claimed invention. Note all the figures, and especially figures 4 and 5 for the oxide VCSEL. They illustrate a laser comprising an active region (110), a contact region (120,220); and a stabilizer module (130a, 130b, 210, 420, 630) for stabilizing the gains among a plurality of modes induced by spatial power instability by increasing (e.g. see col. 4 lines 40-42) the current through the contact region (120,220).

Regarding the high speed communication links, multimode fiber, the 1.2 Gb/s and 2.5 Gb/s frequencies, it has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations. *Ex parte Masham*, 2 USPQ2d 1647 (1987).

Regarding the first module, the second module, the power module, the determination module, and the current module, they are implied by the O'Brien et al reference with its discussions relating to the control electrodes (130a, 130b, 210, 420, 630), which follow:

Detailed Description Text - DETX (7):

The embodiment 100 further implements two metallic control electrodes 130a and 130b that are directly formed over the second cladding layer 118 and the sides of the mesa strip 118a. Alternatively, the control electrodes 130a and 130b may also be located either on the sides of the mesa strip 118a only or on the surfaces of the second cladding layer 118 only. The control electrodes 130a and 130b may be symmetrically located with respect to the ohmic contact 120 and are insulated from the ohmic contact 120. The interface of the control lectr d s 130a r 130b with th s cond cladding lay r 118 and th mesa strip 118a ff cts a Sch ttky c ntact. Thus, a d pl tion regi n can b cr at d within th s c nd cladding lay r 118 and th mesa strip 118a by applying a c ntr l v ltag to apply a r verse bias th Sch ttky contact. The rev rs

bias d Schottky contacts ar n nc nducting and ach pr duce an l ctrostatic field gradi nt in th resp ctiv d pl ti n r gi n t repuls to the carriers. Since such a Schottky contact is formed on both sides of the mesa strip 118a, the carriers are confined within a reduced volume in the central region between the depletion regions. For a given driving current, the current density in the active medium 102 is effectively increased.

Detailed Description Text - DETX (8):

Therefore, the control electrodes 130a and 130b can be used to control the spatial distribution of the carriers and thereby change the current density within the active medium 102 without changing the driving current. When the device 100 is configured to operate as a LED, the control voltage applied to the control electrodes 130a and 130b may be varied to modulate the output light intensity.

Detailed Description Text - DETX (9):

The device 100 can be configured to operate as an edge-emitting laser by forming an optical cavity with the cavity optic axis along the direction of the mesa strip 118a. The control electrodes 130a and 130b can be used to change the laser threshold current by varying the spatial confinement of the carriers. For example, as the bias across the Schottky contact increases within a certain range, the depletion region produced by each control electrode increases, resulting in a reduced spatial profile of the driving current. This causes the laser threshold current to decrease since the current density in the active medium 102 is increased. Hence, the device 100 may be used to achieve a reduced laser threshold. Also, the control electrodes 130a and 130b may be used to provide a laser switch to turn on or off the laser oscillation by varying the current density above and below the laser threshold.

Detailed Description Text - DETX (10):

Furthermore, the control electrodes 130a and 130b may be used to modulate the output power of a laser based on the device 100. The driving current provided by the ohmic contacts 120 and 122 is maintained at a level so that the current density in the active medium 102 is above the laser threshold for a predetermined control voltage on the control electrodes 130a and 130b . Under this condition, the laser is activated and produces a fixed laser power. When the control voltage is changed within a range to alter the current density within the active medium 102 ab ve th las r thr shold, the utput of th las r is also chang d. Th r for , a m dulati n on th contr l voltage to the contr l electrod s 130a and 130b pr duces a m dulati n in th output las r p wer. Such a current m dulati n has simpl r circuitry than many current modulation circuits that c ntr l th driving curr nt since nly th v ltag is m dulat d.

In additi n, the r spons sp d can b v ry fast sinc th RC tim c nstant f the c ntr l l ctr d s can b mad relativ ly small.

Detailed Description Text - DETX (11):

The Schottky contacts formed by the control electrodes 130a and 130b with the cladding layer 118 and the mesa strip 118a are reverse biased in order to achieve the above carrier confinement and operation control. This desired condition requires that the control voltage on each control electrode (130a and 130b) be at a value so that the electrical potential of each control electrode is higher than that of the ohmic contact 120 if the second cladding layer 118 and the second barrier layer 112b are p-doped and the electrical potential of each control electrode is lower than that of the ohmic contact 120 if the second cladding layer 118 and the second barrier layer 112b are n-doped. For example, when the first barrier 112a, the second cladding layer 114 and the substrate 116 are n-doped and the semiconductor layers on the other side of the active layer 110 are p-doped, the ohmic contact 120 can be at a positive voltage and the ohmic contact 122 can be grounded to provide a forward bias to the active layer 110. In this configuration, the potential on either of the control electrodes 130a and 130b should be higher than the positive voltage on the ohmic contact 120.

Detailed Description Text - DETX (12):

The device 100 of FIG. 1 effectively forms a field effect transistor ("FET") where the ohmic contracts 120 and 122 function as the source or drain terminals and the control electrodes 130a and 130b function as the gate for the FET. Since the gate is reverse biased, the gate does not change the magnitude of the driving current but rather controls the dimension of the conduction channel for the driving current.

Detailed Description Text - DETX (14):

FIG. 2A shows a VCSEL 200 having a mesa formation 118b on top of the second cladding layer 118 and a control electrode 210 . Similar to the control electrodes 130a and 130b in the device 100 of FIG. 1, the control electrode 210 forms a reverse-biased Schottky contact with cladding layer 118 and the mesa 118b to provide electrostatic control of the carrier distribution. An ohmic contact 210 on top of the mesa 118b may be transparent or may have an aperture (e.g., a central aperture) to allow for transmission of light. An optical cavity is formed by two ptical refl ct rs 230 and 2 0 t have a cavity ptic axis perp ndicular to th s mic nductor lay rs. The refl ctor 230 is f rm d on t p f the ohmic c ntact 220 and can be mad f any suitabl ptical refl ctive l m nt. A refl ctor having multipl di l ctric lay rs (.g., a distributed Bragg r fl ct r) may b us d as th reflector 230. The oth r reflector 240 may

be a stack f alternating quarter-wav l ngth s mic nduct r lay rs (als a distributed Bragg r fl ct r) f diff r nt indic s at a s l ct d las r wavelength and can be formed between the first cladding layer 114 and the substrate 116. Alternatively, the indices of the layers in the reflector 240 may be chosen to be smaller than that of the active layer 110 so that the reflector 240 may also provide optical confinement and the first cladding layer 114 may be eliminated. As previously, the active medium 102 may be a quantum well structure.

Detailed Description Text - DETX (16):

FIG. 2C shows a VCSEL 204 in which a reflector 230b is used to construct a mesa formation to accommodate the control electrode 210 . The reflector 230b may be a distributed Bragg reflector having alternating quarter-wavelength semiconductor layers of different indices. The second cladding layer 118 may be eliminated if the indices of the quarter-wavelength semiconductor layers are higher than that of the active layer 110.

Detailed Description Text - DETX (17):

FIGS. 2D and 2E show other configurations of VCSELs with a control electrode 210 . In FIG. 2E, the reflector 240b may be made of any suitable optical reflective element. However formed, a VCSEL has an optical cavity enclosing the active layer 110 with the cavity optic axis perpendicular to the semiconductor layers.

Detailed Description Text - DETX (18):

FIG. 3 shows a surface-emitting LED 300 based on the above electrostatic control. A lightly p-doped semiconductor layer 310 and a n-doped semiconductor layer 312 forms a light-emitting p-n junction over a p-substrate 314. The n-doped layer 312 has a mesa 316 to accommodate the control electrode 210 . The control voltage on the control electrode 210 can be varied to change the current density and thereby the output light intensity. An optical reflector may be optionally formed on the p-doped side of the p-n junction and redirect light emitted therein to n-doped layer 312 to increase the output intensity. For example, a Bragg reflector may be formed between the layers 310 and 314.

Detailed Description Text - DETX (21):

An xidati n lay r 412 is f rm d n ach sid f th m sa strip 410 by, f r xampl , using a kn wn xidati n pr c ss r dir ctly d p siting an xid layer. A control lectrod 420 is th n f rm d on ach sid f the m sa strip 410 ov r the r spective xidati n layer 412 and is electrically insulat d fr m th ohmic

c ntact 120. Each c ntr l el ctr d 420 is appli d with a c ntr l p t ntial that caus s a r v rs bias across th control l ctrodes 420 and th s c nd cladding layer 410. Hence, when the second cladding layer 410 is p-doped, the control potential is higher than the electrical potential of the ohmic contact 120; the control potential is lower than the electrical potential of the ohmic contact 120 when the second cladding layer 410 is n-doped. This configuration creates a nonconducting depletion region within the mesa strip cladding layer 410 near the oxidation layer 412. The depletion regions near both sides of the mesa strip cladding layer 410 confine the carriers in the central region. The size of the depletion regions can be varied by changing the control potential. Similar to the Schottky scheme, this provides a control over the current density and can be used to modulate the output light power and to change the threshold current in a laser.

Detailed Description Text - DETX (23):

The devices shown in FIGS. 4 and 5 also effect a metal-oxide field effect transistor ("MOSFET") where the ohmic contracts 120 and 122 function as the source or drain terminals and the control electrodes 420 function as the gate for the MOSFET. Since the gate is reverse biased, the gate does not change the magnitude of the driving current but rather controls the dimension of the conduction channel for the driving current.

Conclusion

13. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Parker et al (5,748,653) and Jiang et al (5,757,836) each teach a VCSEL with a stabilizer module.

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Quyen P. Leung whose telephone number is (703) 308-0545. The examiner can normally be reached on 8:30-5:00, M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Ip can be reached on (703) 308-3098. The fax phone numbers for the

organization where this application or proceeding is assigned are (703) 308-7724 for regular communications and (703) 308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Quyen P. Leung
Primary Examiner
Art Unit 2828

QPL
January 9, 2003